CN1200008
PUB DATE: 1998-11-25
APPLICANT: MATSUSHITA ELECTRIC IND CO LTD [JP]

HAS ATTACHED HERETO CORRESPONDING ENGLISH LANGUAGE EQUIVALENT:

US6148216
PUB DATE: 2000-11-14
APPLICANT: MATSUSHITA ELECTRIC IND CO LTD [JP]

No documents available for this priority number.

Espacenet

Bibliographic data: CN1200008 (A) — 1998-11-25

System and method for wireless communications

Inventor(s): YOSHIHARU OSAKI [JP] ± (OSAKI YOSHIHARU)

Applicant(s): MATSUSHITA ELECTRIC IND CO LTD [JP] ± (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD)

Classification: **- international:*H04B7/005; H04B7/26; H04J13/00; H04W52/34;*** (IPC1-7): H04Q7/38
- cooperative: H04W52/343; H04W52/346

Application number: CN19981006617 19980413

Priority number(s): JP19970146059 19970521

Also published as: CN1094713 (C) EP0886387 (A2) EP0886387 (A3) US6148216 (A) JP10322270 (A)

Abstract not available for CN1200008 (A)
Abstract of corresponding document: EP0886387 (A2)

Each gain control amplifier 3 adjusts the transmission power of the transmit signals directed to each user according to the power control signal. Gaussian noise generator 4 generates Gaussian noise. Noise power control section 6 controls gain control amplifier 5 based on the power control signal to each user and total power control signal and adjusts the transmission power of the Gaussian noise so that the summation of the transmission power may be kept constant.

[19]中华人民共和国专利局

[51]Int.Cl[6]
H04Q 7/38

[12] 发明专利申请公开说明书

[21] 申请号 98106617.8

[43]公开日 1998 年 11 月 25 日

[11] 公开号 CN 1200008A

[22]申请日 98.4.13

[30]优先权

[32]97.5.21 [33]JP[31]146059/97

[71]申请人 松下电器产业株式会社

地址 日本国大阪府

[72]发明人 大崎吉晴

[74]专利代理机构 上海专利商标事务所

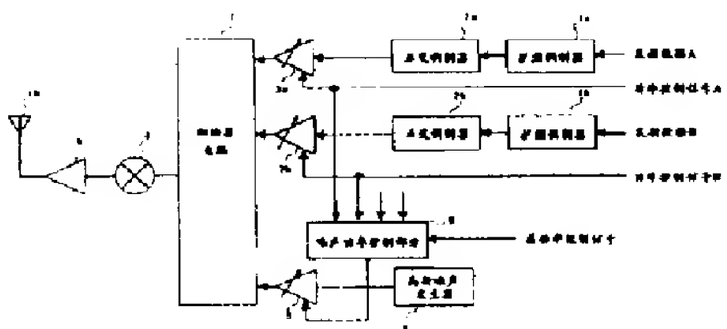
代理人 张政权

权利要求书 2 页 说明书 4 页 附图页数 4 页

[54]发明名称 无线通信系统和方法

[57]摘要

一种无线通信系统和方法。每个增益控制放大器 3 根据功率控制信号调节指向每个用户的发射信号的发射功率。高斯噪声发生器 4 产生高斯噪声。噪声功率控制部分 6 根据每个用户的功率控制信号和总功率控制信号控制增益控制放大器 5 并调节高斯噪声的发射功率，使发射功率之和保持不变。



权　利　要　求　书

1.一种无线通信基地台装置，其特征在于包括:

噪声发生装置，用于产生噪声;

噪声功率控制装置，用于控制所述噪声的发射功率，使每一用户信道的发射功率与所述噪声之和可保持不变。

2. 如权利要求 1 所述的无线通信基地台装置，其特征在于: 所述噪声功率控制装置控制所述噪声的发射功率，使每一用户信道的发射功率与噪声之和等于总功率。

3. 一种无线通信基地台装置，其特征在于包括:

噪声发生装置，用于产生噪声;

噪声功率控制装置，用于控制所述噪声的发射功率，使每一用户信道的发射功率与所述噪声之和可保持不变;

加法装置，用于将每一用户信道的发射信号与所述噪声相加，以产生复合信号;

归一化装置，用于对所述复合信号进行归一化;

功率控制装置，用于控制所述归一化复合信号的发射功率。

4. 如权利要求 3 所述的无线通信基地台装置，其特征在于: 所述噪声功率控制装置控制所述噪声的发射功率，使每一用户信道的发射功率与噪声之和等于到目前为止每一用户信道的最大功率之和。

5. 如权利要求 3 所述的无线通信基地台装置，其特征在于: 所述噪声功率控制装置进行控制，使复合信号的发射功率可等于总功率。

6. 一种移动台装置与无线通信基地台装置进行通信的系统，其特征在于，所述无线通信基地台装置包括:

噪声发生装置，用于产生噪声;

噪声功率控制装置，用于控制所述噪声的发射功率，使每一用户信道的发射功率与所述噪声之和可保持不变。

7. 一种移动台装置与无线通信基地台装置进行通信的系统，其特征在于，所述无线通信基地台装置包括:

噪声发生装置，用于产生噪声;

噪声功率控制装置，用于控制所述噪声的发射功率，使每一用户信道的发射功率与所述噪声之和可保持不变；

加法装置，用于将每用户信道的发射信号与所述噪声相加，以产生复合信号；

归一化装置，用于对所述复合信号进行归一化；

功率控制装置，用于控制所述归一化复合信号的发射功率。

8. 一种无线通信方法，其特征在于包括下列步骤：

产生噪声；

控制所述噪声的发射功率，使每一用户信道的发射功率与所述噪声之和可保持不变。

9. 如权利要求 6 所述的无线通信方法，其特征在于：控制噪声的发射功率的步骤控制噪声的发射功率，使每一用户信道的发射功率与噪声之和等于总功率。

10. 一种无线通信方法，其特征在于包括下列步骤：

产生噪声；

控制所述噪声的发射功率，使每一用户信道的发射功率与所述噪声之和可保持不变；

通过使每一用户信道的发射信号与所述噪声相加，产生复合信号；

对所述复合信号进行归一化；

控制所述归一化复合信号的发射功率。

11. 如权利要求 10 所述的无线通信方法，其特征在于：控制噪声的发射功率的步骤控制噪声的发射功率，使每一用户信道的发射功率与噪声之和等于到目前为止每一用户信道的最大功率之和。

12. 如权利要求 10 所述的无线通信方法，其特征在于：控制复合信号的发射功率的步骤进行控制，使复合信号的发射功率可等于总功率。

93·04·15

说　明　书

无线通信系统和方法

本发明涉及汽车电话和便携电话等用的无线通信系统及方法。

诸如汽车电话和便携电话一类的无线通信系统都以同时在一个基地台与多个用户(移动台)之间进行通信的多址联接系统为基础。最近，将可有效利用频率的 CDMA(码分多址联接)系统用作这种多址联接系统。

下面利用图 1 所示的方块图说明传统 CDMA 系统基地台(以下简单称为基地台)的发射部件。如图 1 所示，传统基地台包括：扩频调制部分 101，它利用分配给每个用户的扩频码对待发射给每个用户的发射数据进行扩频；正交调整器 102，它对扩频发射数据进行正交调制；增益控制放大器 103，它根据功率控制信号对经正交调制的发射信号的发射功率进行调节。传统基地台还包括：加法器电路 104，它将经过发射功率放大的每个发射信号相加；混频器 105，它将相加后的发射信号乘以本振频率并将其调制到射频频带；放大器 106，它以恒定的放大率放大已调制到射频频带的发射信号的发射功率；天线 107，它把发射信号发射出去。

以下将描述从传统基地台发射数据/信号的流程。利用分配给用户 A 的扩频码，由扩频调制部分 101a 对指向用户 A 的发射数据 A 进行扩频后，由正交调制器 102a 对其进行调制。根据功率控制信号，由增益控制放大器 103a 对发射信号 A 的发射功率进行调节。其它用户的发射信号以同样的方式分别进行扩频、正交调制和发射功率调节。每个用户的已经过发射功率调节的发射信号由加法器电路 104 进行相加，由混频器 105 将其调制到射频频带，并由放大器 106 以恒定的放大率放大其发射功率后，通过天线 107 以无线电波发射出去。

每个用户接收基地台发射的信号，在对接收信号变频后，利用所分配的扩频码对其进行反向扩频。提取基地台针对该移动台发射的数据。在这个反向扩频过程中，将针对其它移动台的其它信道的发射信号看作是噪声。根据 S/I 比，即针对各移动台的接收数据的发射功率与干扰(噪声)的发射功率之比，每个用户指示基地台针对其移动台的下一个发射数据的发射功率。

这时，当有些用户进行能传输大量数据的猝发传输时，传统的基地台存在因

S/I 比的瞬时变化而引起的传输差错问题，导致其它用户的通信质量降低.

本发明的一个目的是提供一种在有些用户进行猝发传输的情况下稳定其它用户通信质量的无线通信系统及其方法。

本发明提供一种无线通信系统和方法，通过产生噪声，使得发射功率之和维持恒定，从而维持 S/I 比恒定不变，防止猝发传输的传输差错，达到上述目的。

图 1 是传统 CDMA 系统基地台的发射部件的方块图。

图 2 是本发明实施例 1 的 CDMA 系统基地台的发射部件的方块图。

图 3 表明从本发明实施例 1 中 CDMA 系统基地台对每个用户发射的发射数据的发射功率随时间的变化。

图 4 是本发明实施例 2 的 CDMA 系统基地台的发射部件的方块图。

以下参考附图详细描述本发明的具体实施例.

(实施例 1)

在实施例 1 中，将介绍一种无线通信系统和方法，它通过控制所发生噪声的发射功率，维持发射信号的发射功率之和恒定不变。

图 2 是实施例 1 中 CDMA 系统基地台(以下简称为“基地台”)的发射部件的方块图. 如图 2 所示，实施例 1 中的基地台包括：扩频调制部分 1，它利用分配给每个用户的扩频码对待发射给每个用户的发射数据进行扩频；正交调整器 2，它对扩频发射数据进行正交调制；增益控制放大器 3，它根据功率控制信号对经正交调制的发射信号的发射功率进行调节. 此外，实施例 1 中的基地台还包括：高斯噪声发生器 4，它产生高斯噪声；增益控制放大器 5，用于对高斯噪声的发射功率进行调节；噪声功率控制部分 6，它根据每个用户的功率控制信号和总功率控制信号控制增益控制放大器 5；加法器电路 7，它将经过发射功率放大的每个发射信号与产生的高斯噪声相加。以下把加法器电路 7 相加后的发射信号和高斯噪声称为“复合信号”。

此外，实施例 1 中的基地台还包括：混频器 8，它使相复合信号乘以本振频率并将其调制到射频频带；放大器 9，它以恒定的放大率放大已调制到射频频带的复合信号的发射功率；天线 10，它用无线电波把复合信号发射出去。

以下将描述从实施例 1 的基地台发射数据的流程。

利用分配给用户 A 的扩频码，由扩频调制部分 1a 对指向用户 A 的发射数据 A 进行扩频，再由正交调整器 2a 对其进行调制. 然后，根据功率控制信号，由增

益控制放大器 3a 对发射信号 A 的发射功率进行调节．以同样的方式也对指向其它用户的发射数据分别进行扩频、正交调制和发射功率调节．高斯噪声发生器 4 产生高斯噪声，通过噪声功率控制部分 6 的控制，由增益控制放大器 5 对高斯噪声的发射功率进行调节．

然后，由加法器电路 7 对发射功率已经过调节的各发射信号和高斯噪声进行相加，由混频器 8 将其调制到射频频带内，并由放大器 9 对以恒定的放大率放大发射功率后，通过天线 10 以无线电波发射出去。

每个用户接收基地台发射的信号，在对接收信号进行变频后，利用所分配的一扩频码对其进行反向扩频。提取针对该移动台的信号．在这个反向扩频过程中，将从基地台其它信道发射的针对其它移动台的发射数据看作是噪声．根据 S/I 比，即针对各移动台的接收信号的发射功率与干扰(噪声)的发射功率之比，每个用户指示基地台针对其移动台的下一个发射信号的发射功率．

然后，利用图 3 详细描述噪声功率控制部分 6 进行的控制．图 3 表明从实施例 1 中基地台对每个用户发射的发射信号的发射功率随时间的变化。在图 3 中，水平轴代表时间，垂直轴代表包括高斯噪声在内的基地台发射信号的发射功率之和。在图 3 中，有用户 A 和用户 B 两个移动台与基地台进行通信．基地台向用户 A 发射的发射功率保持不变，而向 B 进行猝发传输的发射功率显著变化。

噪声功率控制部分 6 输入功率控制信号并通过从总功率中减去每个发射信号的发射功率，计算高斯噪声的发射功率．然后，根据计算结果控制增益控制放大器 5．即把高斯噪声(图中的阴影区)加到发射信号 B 的发射功率(白色区)，使图 3 中发射功率之和 P 相对时间 “ t ” 保持不变。

发射功率之和是由通信系统中基地台的容量或者由基地台所覆盖蜂窝区的范围确定的。

因此，把高斯噪声加到每个用户的发射信号中，使基地台发射的发射信号的发射功率之和保持不变，可使用户 B 的接收信号的 S/I 比保持不变，从而保持通信质量稳定。由于高斯噪声与针对其它用户的发射信号是正交的，因此，通过在接收方的反向扩频，完全能消除它。

(实施例 2)

以下将说明实施例 2 中，在将所发生噪声的发射功率降至最低的同时维持各

发射信号的发射功率与噪声之和不变的无线通信系统和方法。

图 4 示出实施例 2 中基地台的发射部件的方块图. 用相同的符号表示与图 2 共同的部分，对其描述从略. 在图 4 中，噪声功率控制部分 20 输入每个用户的功率控制信号以及到目前为止存储器(图中未示出)所存每一用户信道的最大功率之和（以下称之为“最大功率值”），并通过从最大功率值中减去通信中所涉及全部用户的总功率，计算高斯噪声的发射功率。噪声功率控制部分 20 根据计算结果控制增益控制放大器 6．在这种情况下，当前的发射功率之和低于最大功率值，短缺部分就由高斯噪声来补充，可将高斯噪声的发射功率抑制到所需的最小值.

归一化部分 21 把从加法器电路 7 输出的复合信号的发射功率归一化为最大功率值并将其输出到全信道正交调整器 22 。全信道正交调制器 22 对全部信道的归一化发射数据进行正交调制并将其输出到增益控制放大器 23 .

增益控制放大器 23 根据总功率控制信号控制全部信道的已正交调制发射信号的发射功率并将其输出到混频器 8 。即使最大功率值变化，这也能够使相加后的信号的发射功率保持不变.

以下将说明实施例 2 中基地台的发射数据的流程.

利用分配给用户 A 的扩频码，由扩频调制部分 1a 对指向用户 A 的发射数据 A 进行扩频。根据功率控制信号，由增益控制放大器 3a 对发射信号 A 的发射功率进行调节。以同样的方式还对指向其它用户的发射数据分别进行扩频，对其发射功率调节。从高斯噪声发生器 4 产生高斯噪声，通过噪声功率控制部分 20 的控制，由增益控制放大器 5 对高斯噪声的发射功率进行调节。由加法器电路 7 对发射功率已经过调节的各发射信号和高斯噪声进行相加并由归一化部分 21 对其进行归一化。归一化后的复合信号由全信道正交调制器 22 进行正交调制，再由混频器 8 将其调制到射频频带，并由放大器 9 以恒定的放大率放大其发射功率后，通过天线 10 以无线电波发射出去。

因此，将高斯噪声加在每个用户的发射数据中，保持基地台发射的发射信号的发射功率之和不变，即维持用户 A 的接收数据的 S/I 比不变，从而稳定通信质量。此外，使高斯噪声的发射功率等于最大功率值与发射功率当前之和的差，能够把高斯噪声的发射功率抑制到所需的最低水平。

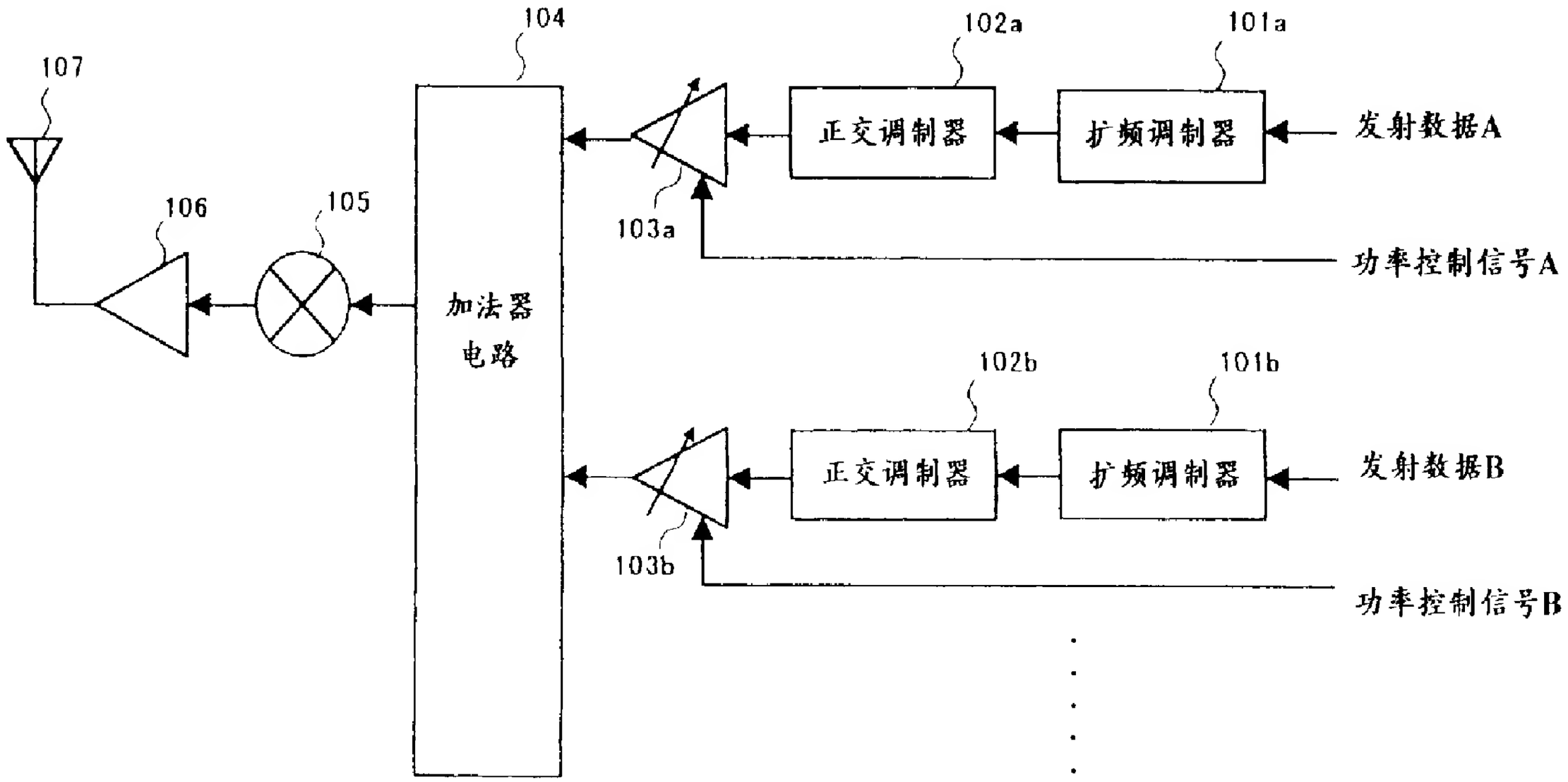

104
107
102a
101a
正交调制器
扩频调制器
发射数据A
106
105
103a
功率控制信号A
加法器
电路
102b
101b
正交调制器
扩频调制器
发射数据B
103b
功率控制信号B

图 1

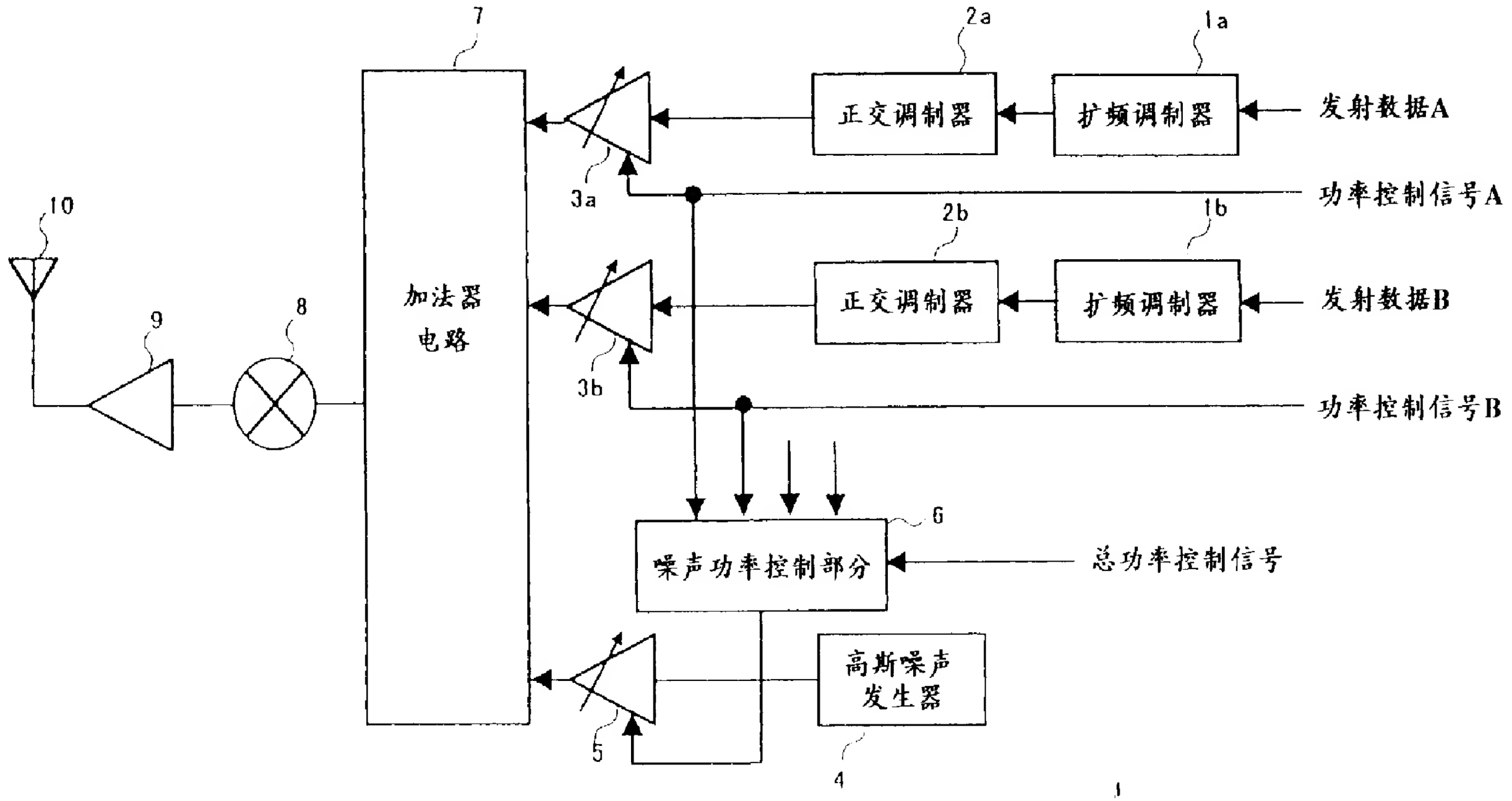

7
2a
1a
正交调制器
扩频调制器
发射数据A
3a
功率控制信号A
2b
1b
正交调制器
扩频调制器
发射数据B
10
9
8
加法器
电路
3b
功率控制信号B
6
噪声功率控制部分
总功率控制信号
高斯噪声
发生器
5
4

图 2

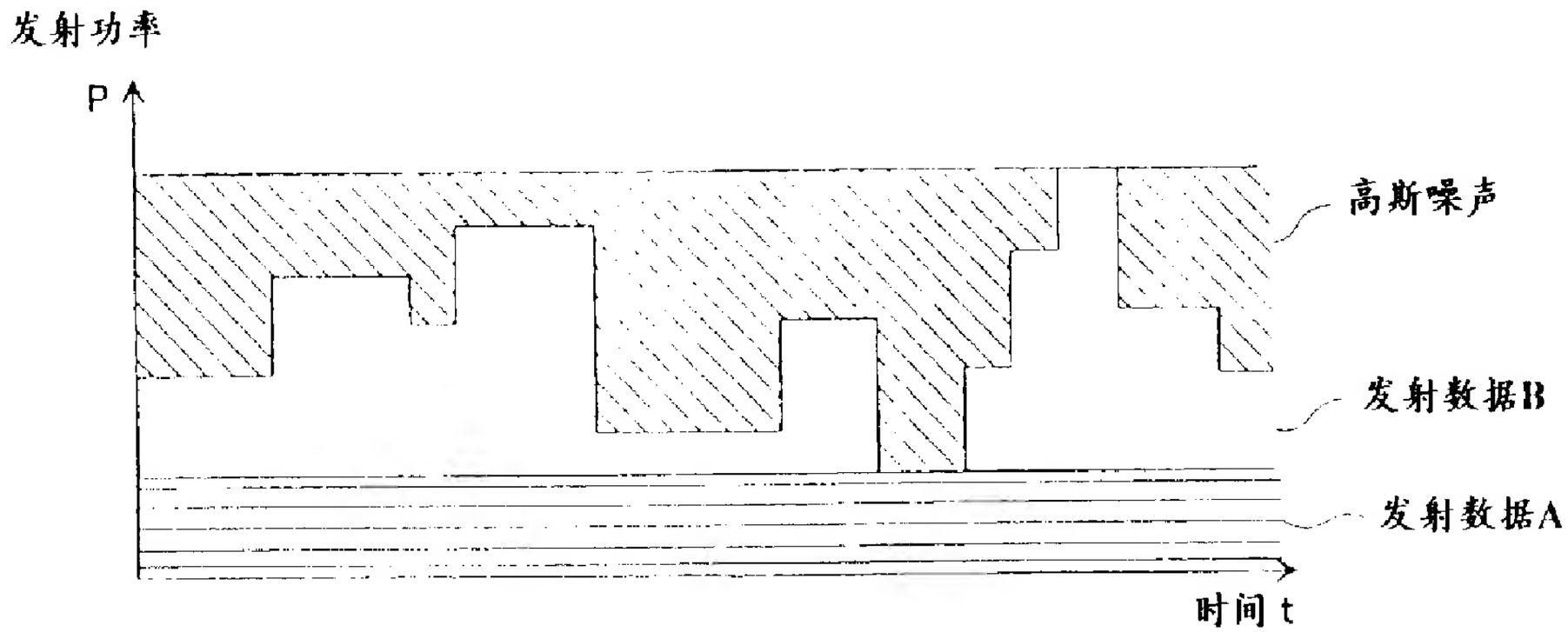


图 3

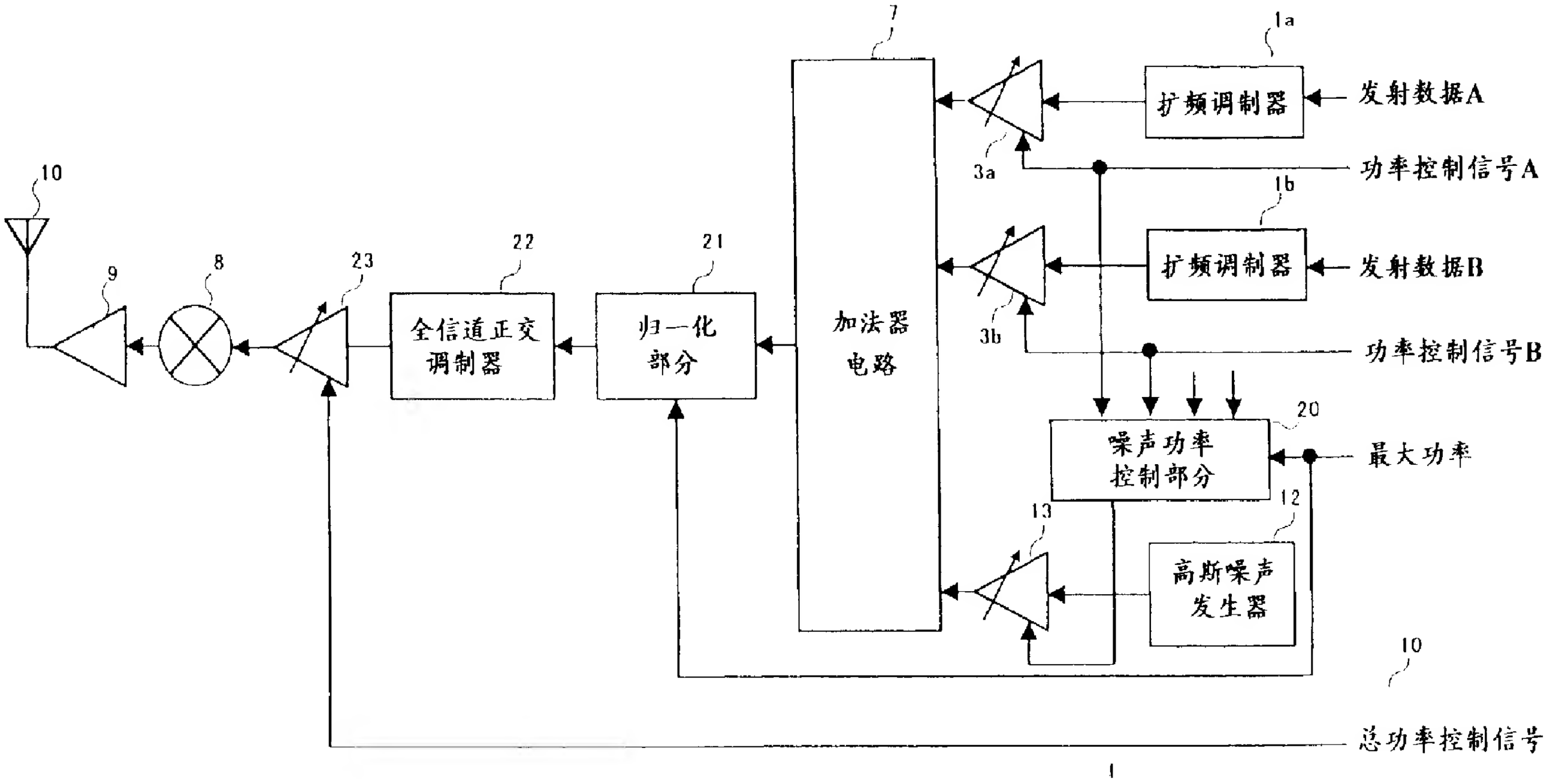

7
1a
扩频调制器
发射数据A
3a
功率控制信号A
1b
扩频调制器
发射数据B
3b
功率控制信号B
20
噪声功率
控制部分
最大功率
12
13
高斯噪声
发生器
10
总功率控制信号
加法器
电路
归一化
部分
21
全信道正交
调制器
22
23
8
9
10

图 4

US006148216A

United States Patent [19]

Osaki

[11] Patent Number: 6,148,216

[45] Date of Patent: Nov. 14, 2000

[54] **SYSTEM AND METHOD FOR WIRELESS COMMUNICATIONS**

[75] Inventor: **Yoshiharu Osaki**, Yokohama, Japan

[73] Assignee: **Matsushita Electric Industrial Co., Ltd.**, Osaka, Japan

[21] Appl. No.: **09/058,882**

[22] Filed: **Apr. 13, 1998**

[30] **Foreign Application Priority Data**

May 21, 1997 [JP] Japan 9-146059

[51] **Int. Cl.**[7] **H04Q 7/20**

[52] **U.S. Cl.** **455/561**; 455/127

[58] **Field of Search** 455/561, 522, 455/67.1, 423, 127

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,570,265	2/1986	Thro	455/561
5,659,892	8/1997	Soleimani et al.	455/127
5,710,981	1/1998	Kim et al.	455/127
5,809,420	9/1998	Ichiyanagi et al.	455/127

FOREIGN PATENT DOCUMENTS

7-107033	4/1995	Japan .
8-18503	1/1996	Japan .
8-32513	2/1996	Japan .
8-32515	2/1996	Japan .
96/37972	11/1996	WIPO .

OTHER PUBLICATIONS

Copy of an English Language Abstract of JP No. 7–107033.

Copy of an English Language Abstract of JP No. 8–18503.

Copy of an English Language Abstract of JP No. 8–32513.

Copy of an English Language Abstract of JP No. 8–32515.

Primary Examiner—Daniel S. Hunter
Assistant Examiner—Myron K. Wyche
Attorney, Agent, or Firm—Greenblum & Bernstein, P.L.C.

[57] **ABSTRACT**

Each gain control amplifier **3** adjusts the transmission power of the transmit signals directed to each user according to the power control signal. Gaussian noise generator **4** generates Gaussian noise. Noise power control section **6** controls gain control amplifier **5** based on the power control signal to each user and total power control signal and adjusts the transmission power of the Gaussian noise so that the summation of the transmission power may be kept constant.

14 Claims, 4 Drawing Sheets

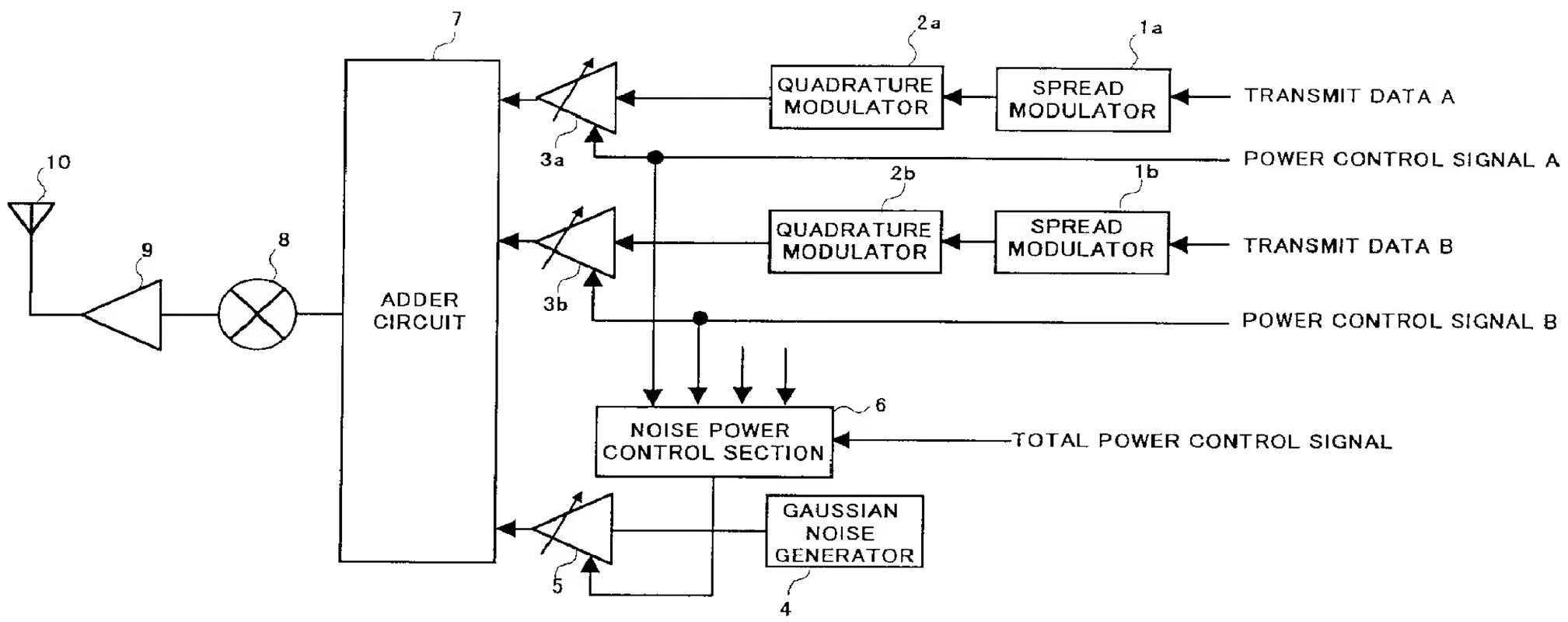


FIG.1 PRIOR ART

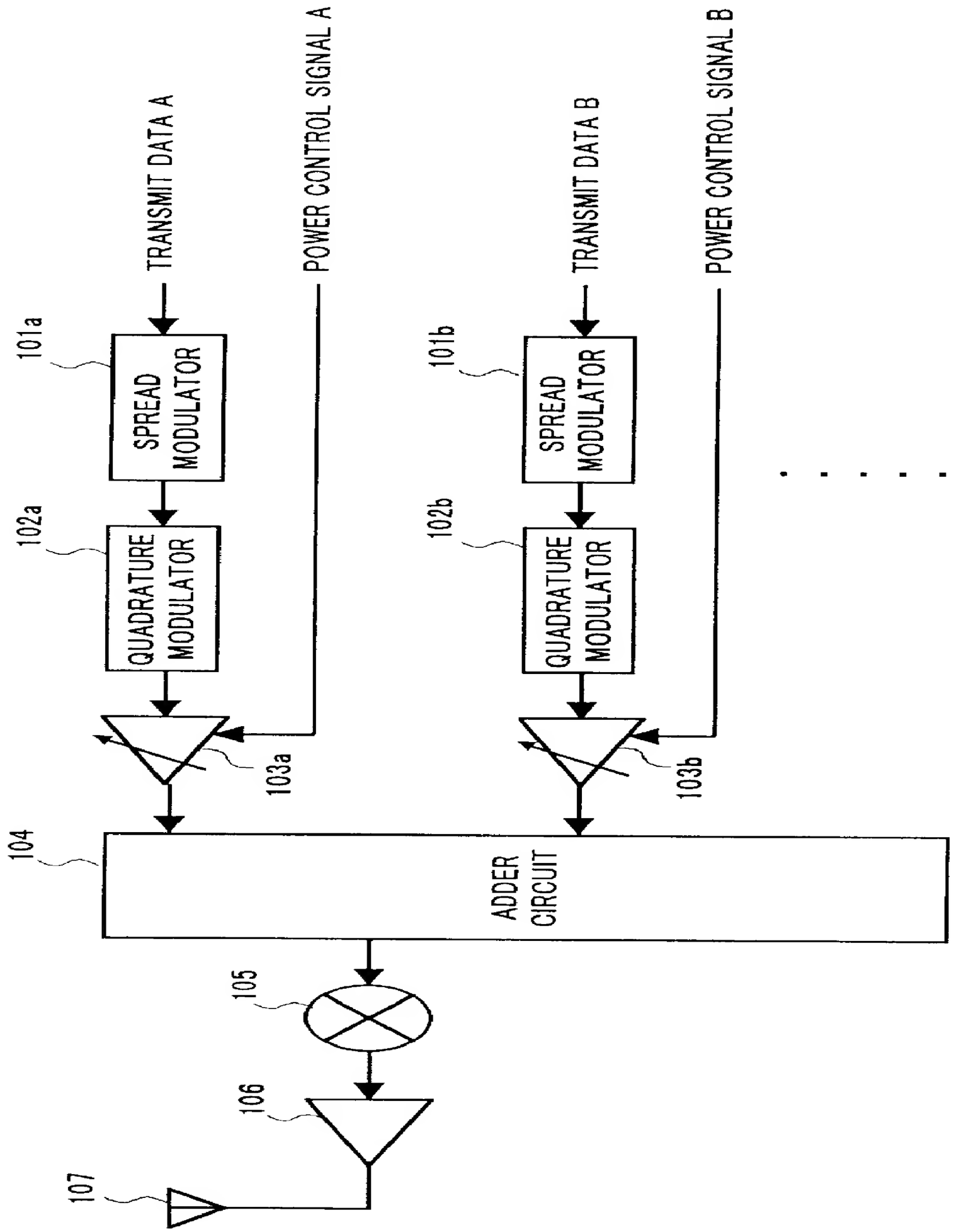
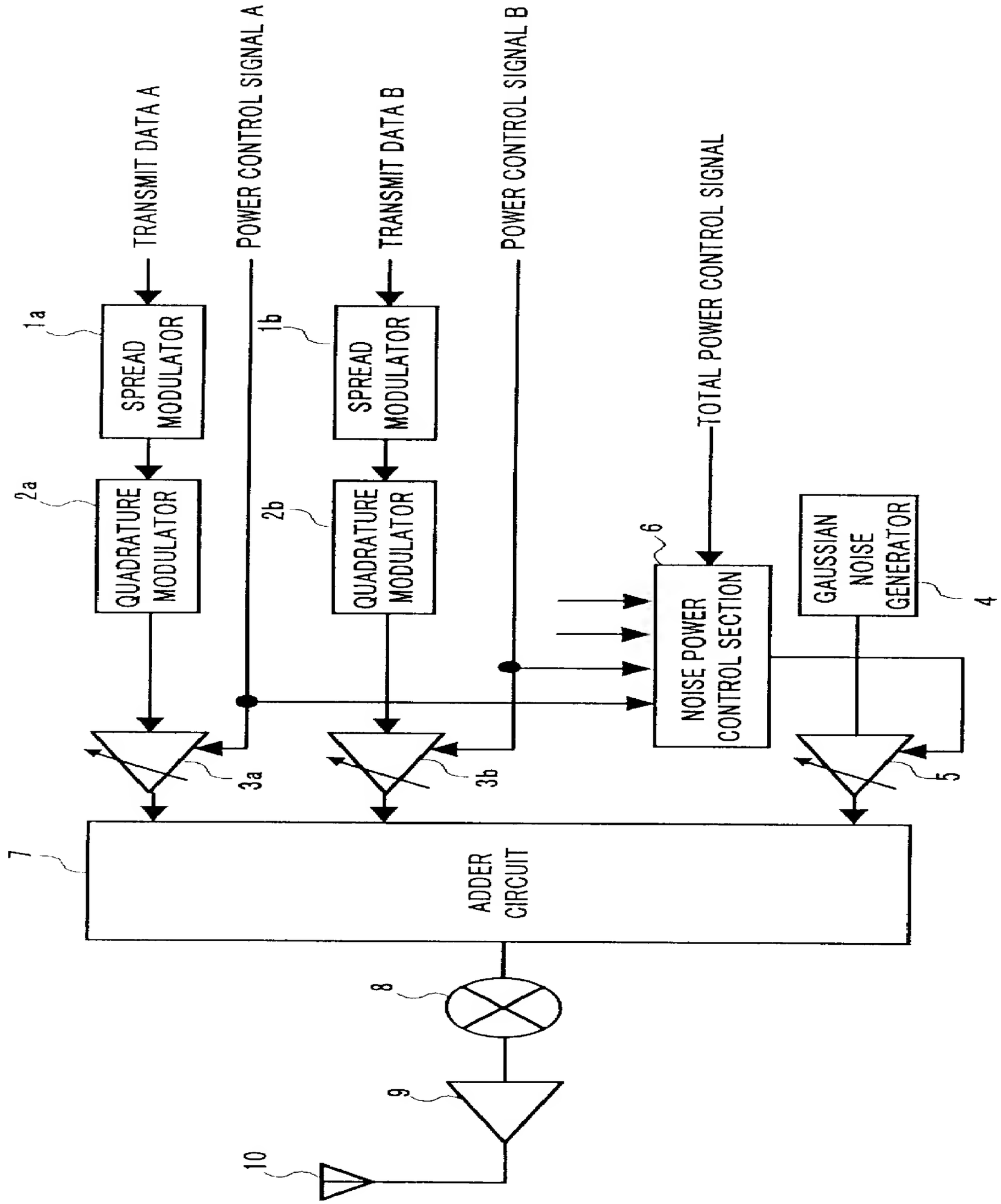


FIG.2


TRANSMIT DATA A
POWER CONTROL SIGNAL A
TRANSMIT DATA B
POWER CONTROL SIGNAL B
TOTAL POWER CONTROL SIGNAL
1a
1b
SPREAD MODULATOR
SPREAD MODULATOR
2a
2b
QUADRATURE MODULATOR
QUADRATURE MODULATOR
6
NOISE POWER CONTROL SECTION
GAUSSIAN NOISE GENERATOR
4
3a
3b
5
7
ADDER CIRCUIT
8
9
10

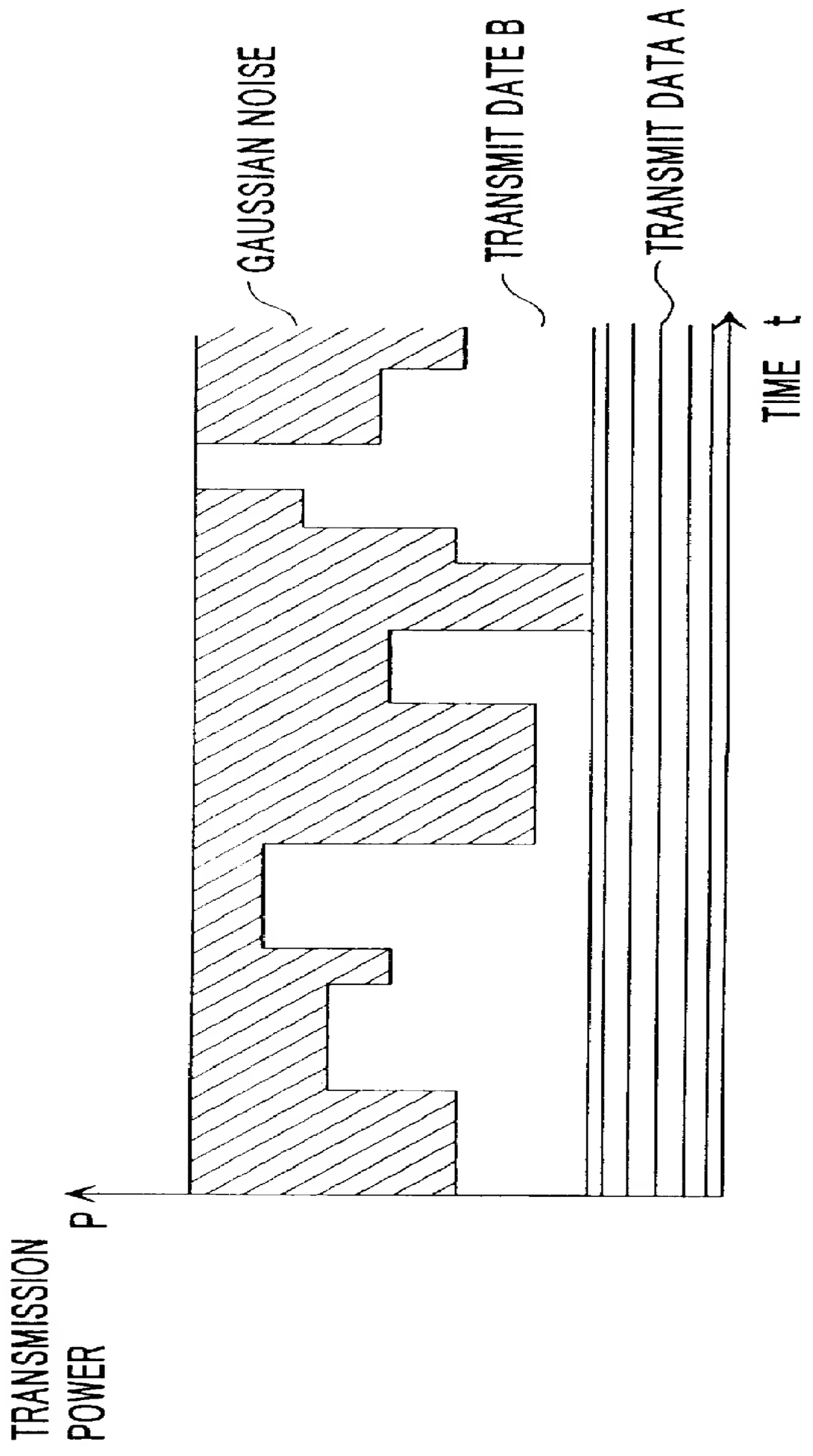

GAUSSIAN NOISE
TRANSMIT DATE B
TRANSMIT DATA A
TIME t
TRANSMISSION POWER P

FIG. 3

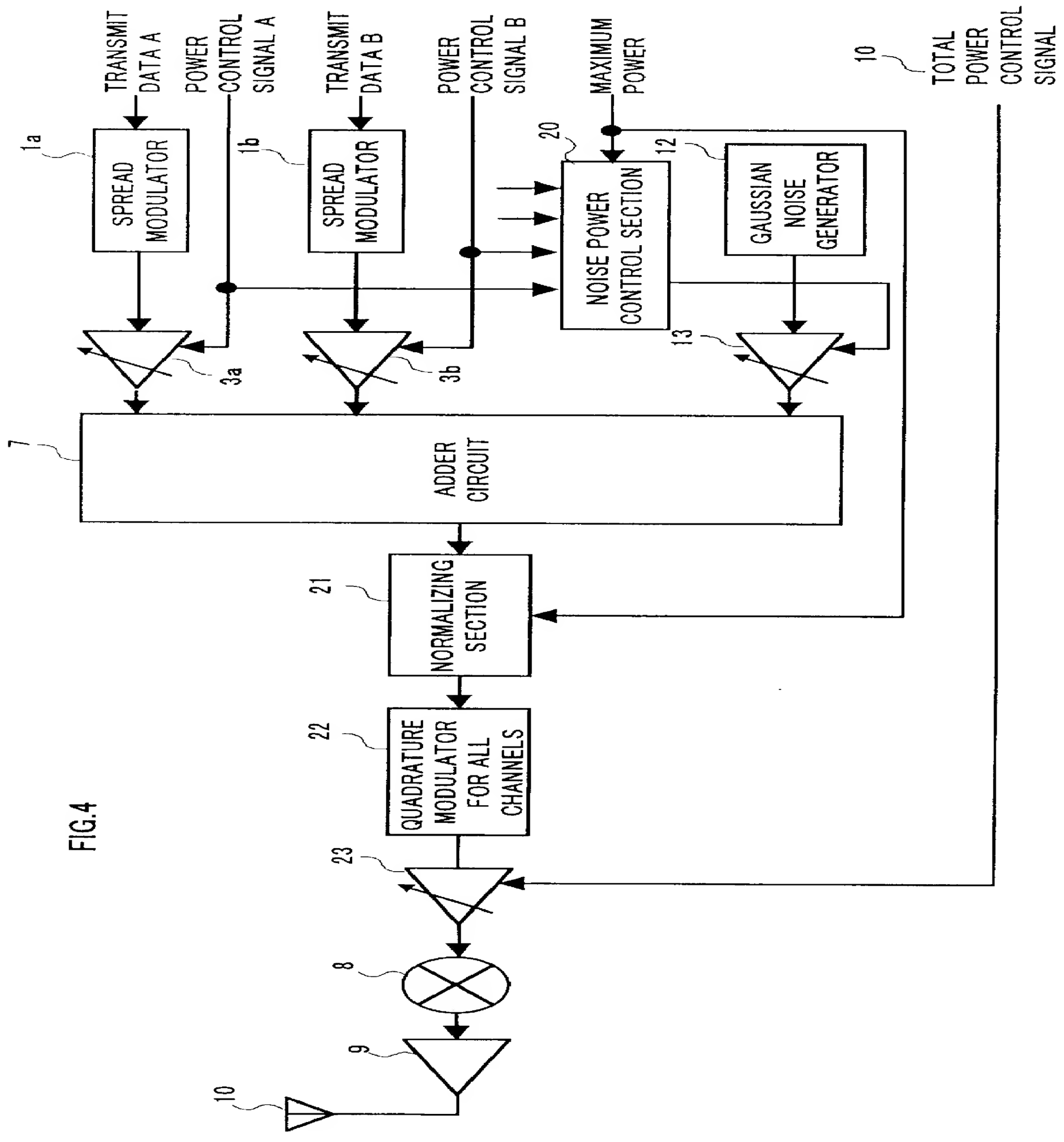

TRANSMIT DATA A
POWER CONTROL SIGNAL A
TRANSMIT DATA B
POWER CONTROL SIGNAL B
MAXIMUM POWER
10
TOTAL POWER CONTROL SIGNAL
1a
SPREAD MODULATOR
1b
SPREAD MODULATOR
20
NOISE POWER CONTROL SECTION
12
GAUSSIAN NOISE GENERATOR
3a
3b
13
7
ADDER CIRCUIT
21
NORMALIZING SECTION
22
QUADRATURE MODULATOR FOR ALL CHANNELS
23
8
9
10

FIG.4

SYSTEM AND METHOD FOR WIRELESS COMMUNICATIONS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to wireless communication systems used for car telephones and portable telephones, etc. and their methods.

2. Related Art

Wireless communication systems such as car telephones and portable telephones are based on a multiple access system in which communications are performed simultaneously between one base station and multiple users (mobile stations). Recently, the CDMA (Code Division Multiple Access) system, which allows efficient use of frequencies, is used as this multiple access system.

The transmission block of a conventional CDMA system base station (hereafter simply referred to as "base station") is described below using a block diagram in FIG. **1**. As shown in FIG. **1**, a conventional base station has spread modulation section **101** which spreads the transmit data to be transmitted to each user using a spread code assigned to each user, quadrature modulator **102** which quadrature-modulates the spreading transmit data, and gain control amplifier **103** which adjusts the transmission power of the quadrature-modulated transmit signals which is modulated according to a power control signal. The conventional base station also has adder circuit **104** which adds each transmit signals whose transmission power has been amplified, mixer **105** which multiplies the added transmit signals by a local frequency and modulates it into a radio frequency band, amplifier **106** which amplifies the transmission power of the transmit signals modulated into the radio frequency band by a constant amplification factor, and antenna **107** which transmits the transmit signals.

The flow of the transmit data/signals at the conventional base station is described below: Transmit data A directed to user A is spreading using a spread code assigned to user A by spread modulation section **101***a* and quadrature-modulated by quadrature modulator **102***a*. The transmission power of transmit signals A is adjusted by gain control amplifier **103***a* based on a power control signal. The transmit signals of other users is each spreading, quadrature-modulated and its transmission power adjusted in the like manner. Each user's transmit signals whose transmission power has been adjusted is added by adder circuit **104**, modulated into a radio frequency band by mixer **105**, with the transmission power amplified by amplifier **106** by a constant amplification factor, and transmitted by radio through antenna **107**.

Each user receives the signals transmitted from the base station and after converting the frequency of the receive signals, inversely spreads it using an assigned spread code to extract the data transmitted from the base station directed to the mobile station. In this inverse spreading process, the transmit signals of other channels directed to other stations acts as noise. Each user indicates the base station the transmission power of the next transmit data directed to the station based on an S/I ratio which is the ratio of the transmission power of the receive data directed to the station to the transmission power of interference (noise).

At this point, when some users perform burst transmissions capable of transmitting a large volume of data, the conventional base station has the problem of transmit errors caused by an instantaneous variation of the S/I ratio, resulting in a deterioration of the quality of communications by the other users.

SUMMARY OF THE INVENTION

It is an objective of the present invention to provide a wireless communication system and its method in the case that some users perform burst transmissions, to stabilize the quality of communications with other users.

The present invention achieves the above objective by providing a wireless communication system and its method which keeps the S/I ratio constant by generating noise so that the summation of the transmission power may be kept constant, thus preventing transmit errors in burst transmissions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of the transmit block of a conventional CDMA system base station;

FIG. **2** is a block diagram of the transmit block of the CDMA system base station in Embodiment 1 of the present invention;

FIG. **3** is a graph showing time variations of the transmission power of the transmit data directed to each user transmitted from the CDMA system base station in Embodiment 1 of the present invention;

FIG. **4** is a block diagram of the transmit block of the he CDMA system base station in Embodiment 1 of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The actual embodiments of the present invention are detailed below with reference to figures.

(Embodiment 1)

In Embodiment 1, a wireless communication system and its method which keeps the summation of the transmission power of the transmit signals constant by controlling the transmission power of noise generated is explained.

FIG. **2** is a block diagram of the transmit block of the CDMA system base station (hereafter simply referred to as "base station") in Embodiment 1. As shown in FIG. **2**, the base station in Embodiment 1 has spread modulation section **1** which spreads the transmit data to be transmitted to each user using a spread code assigned to each user, quadrature modulator **2** which quadrature-modulates the spreading transmit data, and gain control amplifier **3** which adjusts the transmission power of the quadrature-modulated transmit signals according to a power control signal. Furthermore, the base station in Embodiment 1 has Gaussian noise generator **4** which generates Gaussian noise, gain control amplifier **5** which adjusts the transmission power of Gaussian noise, noise power control section **6** which controls gain control amplifier **5** based on the power control signal to each user and a total power control signal, and adder circuit **7** which adds each transmit signals whose transmission power has been amplified and the Gaussian noise generated. The transmit signals and Gaussian noise added by adder circuit **7** is hereafter referred to as "multiplex signals."

Furthermore, the base station in Embodiment 1 has mixer **8** which multiplies the multiplex signals by a local frequency and modulates it into a radio frequency band, amplifier **9** which amplifies the transmission power of the multiplex signals modulated into the radio frequency band by a constant amplification factor, and antenna **10** which transmits the multiplex signals by radio.

The flow of the transmit data at the base station of Embodiment 1 is described below:

Transmit data A directed to user A is spread using a spread code assigned to user A by spread modulation section **1***a* and quadrature-modulated by quadrature modulator **2***a*. The transmission power of transmit signals A is then adjusted by gain control amplifier **3***a* based on a power control signal. The transmit data directed to other users is also each spread, quadrature-modulated, and its transmission power adjusted in the like manner. Gaussian noise is generated by Gaussian noise generator **4** and the transmission power of Gaussian noise is adjusted by gain control amplifier **5** through control of noise power control section **6**.

Then, each transmit signals whose transmission power has been adjusted and the Gaussian noise are added by adder circuit **7**, modulated into a radio frequency band by mixer **8**, with the transmission power amplified by a constant amplification factor by amplifier **9**, and transmitted by radio from antenna **10**.

Each user receives the signals transmitted from the base station and after converting the frequency of the receive signals, inversely spreads it using an assigned spread code to extract the signal directed to the mobile station. In this inverse spreading process, the transmit data transmitted from the base station of other channels directed to other stations acts as noise. Each user indicates the base station the transmission power of the next transmit signals directed to the station based on an S/I ratio which is the ratio of the transmission power of the receive signals directed to the station to that of interference (noise).

Then, the control performed by noise power control section **6** is explained in detail using FIG. **3**. FIG. **3** is a graph showing a time variation of the transmission power of the transmit signals directed to each user transmitted from the base station in Embodiment 1. In FIG. **3**, the horizontal axis represents the time and the vertical axis represents the summation of the transmission power of the base station transmit signals including Gaussian noise. In FIG. **3**, two stations are communicating with the base station; user A and user B. The base station transmits to user A with a constant transmission power, while performing burst transmission whose transmission power changes drastically to user B.

Noise power control section **6** inputs a power control signal and calculates the transmission power of the Gaussian noise by subtracting the transmission power of each transmit signals being transmitted from the total power. It then controls gain control amplifier **5** based on the calculation result. That is, it adds the Gaussian noise (hatched area in the figure) to the transmission power of transmit signals B (the white area) so that the summation of the transmission power P may be kept constant with respect to time "t" in FIG. **3**.

The summation of the transmission power is determined by the capacity of the base station or by the cell range of the base station in the communication system.

Thus, adding the Gaussian noise to the transmit signals to each user keeps the summation of the transmission power of the transmit signals transmitted from the base station constant, which keeps the S/I ratio of the receive signals for user A constant, resulting in stabilization of the quality of communications. Since the Gaussian noise is orthogonal to the transmit signals directed to other users, it is completely eliminated through inverse spreading on the receiving side. (Embodiment 2)

In Embodiment 2, a wireless communication system and its method which keeps the summation of the transmission power of the transmit signals and noise constant while minimizing the transmission power of noise generated is explained below.

FIG. **4** is a block diagram of the transmit block of the base station in Embodiment 2. The areas common to FIG. **2** are marked with identical signs and their explanations are omitted. In FIG. **2**, noise power control section **20** inputs the power control signal to each user and the summation of the maximum power of each user channel stored in memory to date which is not illustrated in figures (hereafter referred to as "maximum power value") and calculates the transmission power of Gaussian noise by subtracting the total power of all users engaged in communication from the maximum power value. Noise power control section **20** controls gain control amplifier **6** based on the calculation result. In this case, when the current summation of the transmission power falls short of the maximum power value, the shortage is complemented by Gaussian noise, allowing the transmission power of Gaussian noise to be suppressed to the necessary minimum.

Normalizing section **21** normalized the transmission power of the multiplex signals output from adder circuit **7** to the maximum power value and outputs it to a quadrature modulator for all channels **22**. The quadrature modulator for all channels **22** quadrature-modulates the normalized transmit data for all channels and outputs it to gain control amplifier **23**.

Gain control amplifier **23** controls the transmission power of the transmit signals quadrature-modulated for all channels based on the total power control signal and outputs it to mixer **8**. This allows the transmission power of the added signals to be kept constant even if the maximum power value changes.

The flow of the transmit date at the base station in Embodiment 2 is explained below. Transmit data A directed to user A is spread by spread modulation section la using a spread code assigned to user A. The transmission power of transmit signals A is adjusted by gain control amplifier **3***a* according to the power control signal. The transmit data directed to other users is also each spread and its transmission power adjusted in the like manner. Gaussian noise is generated from Gaussian noise generator **4** and the transmission power of the Gaussian noise is adjusted by gain control amplifier **5** through control of noise power control section **20**. Each transmit signals and Gaussian noise whose transmission power has been adjusted are added by adder circuit **7** and normalized by normalizing section **21**. The normalized multiplex signals is quadrature-modulated by quadrature modulator **22** for all channels, modulated into a radio frequency band by mixer **8**, and after its transmission power is amplified by a constant amplification factor by amplifier **9**, transmitted by radio from antenna **10**.

Thus, adding the Gaussian noise to the transmit data to each user keeps the summation of the transmission power of the transmit signals transmitted from the base station constant, which keeps the S/I ratio of the receive data for user A constant stabilizing the quality of communications. Furthermore, making the transmission power of the Gaussian noise the difference between the maximum power value and the current summation of the transmission power allows the transmission power of the Gaussian noise to be suppressed to the necessary minimum.

What is claimed is:

1. A wireless communication base station apparatus, comprising:

a noise generator that generates noise; and

a noise power controller that controls the transmission power of said noise based on a transmission power of each user channel signal so that a sum of the transmission power of said each user channel signal and said noise is maintained constant.

2. The wireless communication base station apparatus according to claim 1, wherein said noise power controller controls the transmission power of said noise so that the sum of the transmission power of said each user channel signal and said noise is maintained equal to the total power.

3. A wireless communication base station apparatus, comprising:

a noise generator that generates noise;

a noise power controller that controls the transmission power of said noise based upon a transmission power of each user channel signal so that a sum of the transmission power of said each user channel signal and said noise is maintained constant;

an adder that adds transmit signals of said each user channel signal and said noise to generate multiplex signals;

a normalizer that normalizes said multiplex signals; and

a power controller that controls the transmission power of said normalized multiplex signals.

4. The wireless communication base station system according to claim 3, wherein said noise power controller controls the transmission power of said noise so that the sum of the transmission power of said each user channel signal and said noise is maintained equal to the sum of the maximum power of each said user channel signal to date.

5. The wireless communication base station system according to claim 3, wherein said noise power controller ensures that the transmission power of the multiplex signals is maintained equal to the total power.

6. A mobile station apparatus that communicates with a wireless communication base station apparatus, comprising:

a noise generator that generates noise;

a noise power controller that controls the transmission power of said noise based on a transmission power of each user channel signal so that a sum of the transmission power of said each user channel signal and said noise is maintained constant.

7. A mobile station apparatus that communicates with a wireless communication base station apparatus, comprising:

a noise generator that generates noise;

a noise controller that controls the transmission power of said noise based on a transmission power of each user channel signal so that a sum of the transmission power of said each user channel signal and said noise is maintained constant;

an adder that adds transmit signals of said each user channel signal and said noise to generate multiplex signals;

a normalizer that normalizes said multiplex signals; and

a power controller that controls the transmission power of said normalized multiplex signals.

8. A wireless communication method, comprising:

generating noise;

controlling the transmission power of the noise based on a transmission power of each user channel signal so that a sum of the transmission power of each user channel signal and the noise is maintained constant.

9. The wireless communication method according to claim 8, wherein controlling of the transmission power of the noise controls the transmission power of noise so that the sum of the transmission power of each user channel signal and the noise is maintained equal to the total power.

10. A wire less communication method, comprising:

generating noise;

controlling the transmission power of the noise based on a transmission power of each user channel signal so that a sum of the transmission power of each user channel signal and the noise is maintained constant;

generating multiplex signals by adding the transmit signals of each user channel signal and the noise;

normalizing the multiplex signals; and

controlling the transmission power of the normalized multiplex signals.

11. The wireless communication method according to claim 10, wherein the controlling of the transmission power of the noise controls the transmission power of noise so that the sum of the transmission power of each user channel signal and the noise is maintained equal to the sum of the maximum power to date.

12. The wireless communication method according to claim 10, wherein controlling of the transmission power of the multiplex signals ensures that the transmission power of the multiplex signals is maintained equal to the total power.

13. The wireless communication base station apparatus according to claim 1, wherein said noise power controller calculates the transmission power of said noise by subtracting the transmission power of each transmitter user channel signal from the total power.

14. The wireless communication method according to claim 8, wherein controlling the transmission power of noise comprises calculating the transmission power of the noise by subtracting the transmission power of each transmitted user channel signal from the total power.

* * * * *